64

AGRICULTURAL Research

February 1960

U.S. DEPARTMENT OF AGRICULTURE

In the Home

In Processing and Manufacturing

In the Market Place

In the Forest

In Economics and Statistics

On the Farm

AGRICULTURAL RESEARCH TODAY...TOMORROW...

Page 3

AGRICULTURAL Research

Vol. 8—February 1960—No. 8

CONTENTS

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Report

If you take an interest in agricultural research, you're going to hear a lot about this word: CORE. Its letters stand for Committee on Research Evaluation—a group of USDA and State scientists who have conducted one of the most comprehensive studies of agricultural research in our history. The Committee's statement of objectives, evaluations, and recommendations is being spoken of as "the CORE report."

You'll find in our summary of this report (page 3) a suggestion of its breadth and depth. And there's a sampling of the hundreds of CORE recommendations for developing an agricultural research effort that can do its part toward achieving a balanced, progressive, prosperous agriculture.

The report makes it clear that this research effort must be larger than it is now if agriculture is to meet its responsibilities, if its technology is to keep pace in the economy. Our effort needs to be big enough to deal with the whole complex of difficulties that agriculture faces.

It's important to remember that this agricultural technology can't be mass-produced. It must be custom built. It was designed—and is constantly being remodeled—to fit both the limitations and the advantages of the environment. And by environment we mean not only soil, water, climate, and natural hazards but also markets, credit, and transportation, as well as social patterns and communication. Take our crops, which are tailored to a great diversity of conditions: more than 90 percent of our cotton, sugar, oil crops, and grain comes from varieties not in commercial use 25 years ago.

Research, it's true, is only one of many factors that affect agriculture. But research is by far the most important one. It conceives and develops the ideas that grow—with the cooperation of farmers, processors, manufacturers, and merchants—into things that make for progressive change in agriculture and its related and dependent industries.

Research contributes directly to the welfare of farmers. It also provides a foundation for the contributions of others in the economy. Agriculture, the CORE report points out, progresses as research finds new roads to progress.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

AGRICULTURAL RESEARCH:
TODAY . . .
TOMORROW . . .

THE CORE REPORT

The most intensive appraisal ever made of Federal-State research has been completed by CORE—Committee on Research Evaluation. Future objectives were listed, present work reviewed, changes suggested to achieve goals

OBJECTIVES OF AGRICULTURAL RESEARCH

1. To Find What Consumers Need, Want, and Prefer
2. To Find the Inherent Values of Products
3. To Determine Prospective Demand and Supply
4. To Overcome Obstacles to Profitable Adjustments
5. To Build Efficient Structures and Equipment
6. To Conserve Basic Resources
7. To Increase Knowledge of Hazards in Production, Marketing
8. To Protect in National Emergency
9. To Produce, Process, and Market More Efficiently
10. To Increase Product Quality
11. To Develop New and Improved Uses and Markets
12. To Provide Satisfying Levels of Living
13. To Better Organize Farming and Forestry
14. To Better Market Organization and Practices
15. To Better Agricultural Statistics
16. To Determine Effects of Policies and Programs

■ The strength of our economy is due largely to the strength of our agriculture. But agriculture is only as strong as the research that backs it up and keeps it thriving. Technological advances already brought about by research have greatly benefited not only our farm people but the Nation as a whole.

We know that our research in agriculture has so far proved itself. But will it continue to meet the challenges and problems of the future? Do our many lines of work complement and supplement each other? What part should basic research play? Do we need to shift our emphasis on certain lines of work to better achieve our overall objectives? And what *exactly* are those objectives?

The answers to these and other far-reaching questions have come out of one of the most intensive appraisals ever made of our present Federal and State research in agriculture, home economics, and forestry. This was done by a Committee on Research Evaluation (CORE), specially set up by ARS Administrator B. T. Shaw with the cooperation of R. E. McArdle, Administrator, Forest Service, and O. V. Wells, Administrator, Agricultural Marketing Service. The objective of this committee was to take a long look at how far we've come in our research, where we stand now, and where we're heading.

G. W. Irving, Jr., Deputy Administrator, ARS utilization research and development, headed the CORE group. The appraisal was developed by USDA with the cooperation of State agricultural experiment stations and forestry colleges. (Two publications are available in ARS on the CORE report—one detailed, one a summary.)

The CORE scientists first listed 16 research objectives (left) necessary to achieve a balanced, progressive, and prosperous agriculture. They balanced the kind of research we now

THE CORE REPORT
(Continued)

have against the kind we should have to achieve these objectives. And finally, they recommended changes to bring our research more into line with our aims.

These objectives are broad. But detailed attention was given to each in showing how these objectives could be achieved. *Generally*, we'll have to place greater stress on basic research; reduce wastes and losses; improve efficiency of production, processing, marketing, and consumption; develop new and improved crops and products; expand markets; and provide better nutrition and living for farm and city people. And at the same time, we'll have to conserve and improve our basic natural resources of soil, water, forests and ranges.

Now, how far does our present research go in meeting these objectives? A surprisingly *long* way. The majority of our work is responsive to the changing agricultural and world situation, directed towards answering timely and important questions, and our research projects effectively complement and supplement each other.

USDA and the State agricultural experiment stations aren't solely responsible. Private industry and independent research organizations have contributed much. And research advisory committees made up of farmers, businessmen, and scientists, and general farm organizations and commodity groups have provided guidance in planning research.

What can we do to strengthen our research and more nearly bring it into line with our aims? CORE scientists list hundreds of *specific* and *detailed* recommendations.

For one thing, we're too short of people and facilities. More skilled personnel and facilities as well as modernization of present facilities are vital. Basic, too, is a strengthening of cooperative efforts among the Land-Grant colleges, Federal agencies, and private groups in planning and conducting research, in reviewing past farm programs, and in developing and evaluating alternatives. Such review action needs to be strengthened within the agencies also.

There are many ways in which we can improve research on the farm, in the forest, in processing and manufacturing, in the market place, in the home, and in economics and statistics. Here are only a few:

ON THE FARM

Farm research covers crops and livestock. It calls for making effective use of advanced engineering developments and conserving soil and water, and should fit into the national economy in a way that will make farming enterprises profitable.

For instance, the biological, physical, and chemical hazards that beset man's plants and animals and their products from field to table are being widely studied. But methods of control and prevention satisfactory today may be inadequate tomorrow. Basic research is needed on harmful insects; diseases, nematodes, other parasites, and physiological disorders; damage by animals; weeds; weather and other environmental hazards; forest fire damage; air, water, feed, or soil pollutants; and insurance against agricultural risks.

More work is needed on equipment and buildings for livestock production. Emphasis should be put on tillage equipment for soil and water conservation and on irrigation equipment to reduce weather hazards.

The growing importance of livestock products emphasizes the need for more work on biologically active substances in feeds. Many of these substances—allergens, growth inhibitors, toxic chemicals, and others—can cause serious illness in cattle.

More attention should be given to the effects that quarantines, meat and poultry inspections, marketing orders, and regulations on packers and stockyards have upon farm income, food consumption, prices, and the structure of marketing. A study of the interrelations between agriculture and the rest of the economy should be given continuous emphasis.

IN THE FOREST

Expansion of all phases of research on wood is urged. Especially needed are studies on the nature, composition, and reactivity of lignin. Millions of tons of lignin are available yearly in paper mill wastes, yet it's still a chemical mystery.

More efficient planting practices need to be established. New cultural practices to increase production of high-quality seed are necessary—through seed orchards and better methods of harvesting, storing, and processing. Needed also are new and improved practices to facilitate good watershed and livestock grazing management on forest and range lands.

IN PROCESSING, MANUFACTURING

Research to develop new crops and to increase efficient utilization of all agricultural materials needs greater expansion than crop production research. The scientists see a continuation of surpluses, high production and marketing costs, and downward pressure on prices of farmers' products. Greater emphasis is therefore urged on increasing domestic consumption, developing new uses for surplus products, and expanding exports.

For instance, research on utilization of cereal grains should be ex-

panded. Additional work is urged on obtaining new industrial uses for products from animal fats and vegetables, improving the physical and chemical properties of milk, extending the keeping quality of foods, developing products from potential new crops, enhancing poultry flavor, and developing new meat products.

We need to develop markets for forest products, develop new crops and types of animals, and study domestic and foreign markets.

Entirely new and expanded uses for cotton are urged. Greater emphasis should be placed on chemical and biological analyses of meat, milk, and eggs to determine their values and their shortcomings.

IN THE MARKET PLACE

Farmers are now more than ever dependent on marketing services. Marketing research should seek better information on current and prospective markets and try to develop means for widening markets and improving efficiency at all points in our vast marketing system.

There's need for more work to improve the efficiency of assembly plants, transportation and storage facilities, processing plants, wholesale markets, facilities for retailing, handling equipment, and methods and containers. Such improvements can substantially lower marketing costs and in many cases open up valuable new outlets for farm products.

Particular emphasis is recommended on maintaining product quality by controlling insect infestation through better methods of handling and packing. Needed is an appraisal of the merger movement and the consolidation of marketing activities, determination of the economic feasibility of new and improved agricultural products, and facts on consumer and industry preferences, buying habits and other factors in consumption.

IN THE HOME

Major uses for agricultural products are in the home, in the form of food, clothing, and shelter. Home economics research makes use of the physical, biological, and social sciences to gain understanding and control of our environment.

A vast expansion and speedup in our research on the kind of food people want and need is recommended. This includes additional study on: Requirements for essential nutrients by different age and activity groups, physiological food needs, responses to kind and quantity of fat in diets, present pattern of consumption of all goods and services. Benefits of this kind of work to agriculture and to our health would be considerable. Such basic facts could be used as a foundation for guiding production, processing, distribution, and effective consumer use of food.

Intensive study is urged on determining the nutritive value and relative economy of hundreds of food items and how they're affected by geographic source, production methods, processing, storage, marketing, and home or restaurant preparation. Recent advances in techniques make acceleration of this kind of work possible. Results will provide a sounder basis for using present-day products, for developing new and better ones, and for developing better processes with better controls.

CORE scientists also urge expanded studies on family living and rural life, including surveys of how goods and services are used by groups of different levels and incomes.

IN ECONOMICS, STATISTICS

Although our statistical program is considered to be strong, increasing attention should be given to improving the quality and accuracy of statistics in certain specialized fields—such as land use, farm debt, productivity, prices received and paid by farmers, and many others.

More studies are needed to determine the most efficient sizes of farm and forest units in different regions, considering technology, tenure, and financial and other conditions.

Research is needed to discover alternative farm enterprises that will maintain or improve farm incomes. Studies are urged on production responses to changes in technology, prices, costs, Government programs, and other factors to find out how farmers react to such changes. Studies should cover major types of production in different regions.

In planning research, scientists point out the inevitability of change—sometimes revolutionary—that research can bring. These changes may cause financial hardship and upset established ideas, products, and techniques. But the long-run potential benefits to agriculture and to the Nation should be the determining factor in deciding lines of research to follow. It *is* our responsibility, though, to develop means to prevent or alleviate any harmful effects to a large segment of agriculture.

And what about the future of agricultural research in the space age? We aren't yet concerned with growing crops on the moon or any other planet. But future space travelers and pioneer earthlings on other planets will need food, water, air, and other biological necessities. These involve knowledge of the reactions of living organisms—plant and animal—to the rigors of unprecedented environments. This biological research is a field in which agricultural research has traditionally excelled. When the need for these biological necessities arises in our future space explorations, agricultural research can help make them possible.☆

Coming:
TENDERNESS-TESTED MEAT

New hydraulic press provides fast, accurate way to predict how tough or tender meat will be

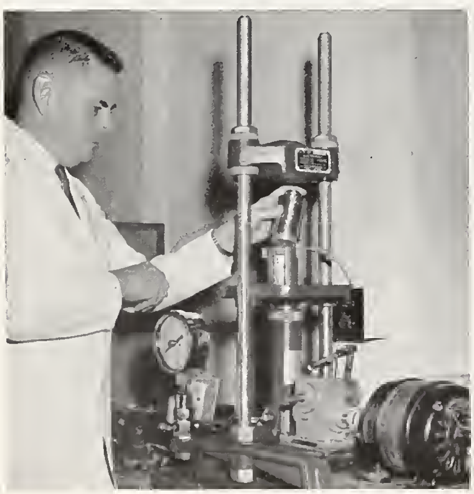
■ It doesn't take much to find out if meat is tender after it's cooked and on the table. The difficulty to packers, retailers, and housewives—geneticists, too—is finding out how tender meat is *before* it's bought.

And this is just what a new USDA-developed press does. This instrument, which measures the tenderness of beef muscles by hydraulic pressure, can test raw meat right out of the slaughterhouse. Moreover, the press can also be used to test biopsy samples from live animals. This may some day enable geneticists to predict tenderness to guide them in producing more animals with tender beef.

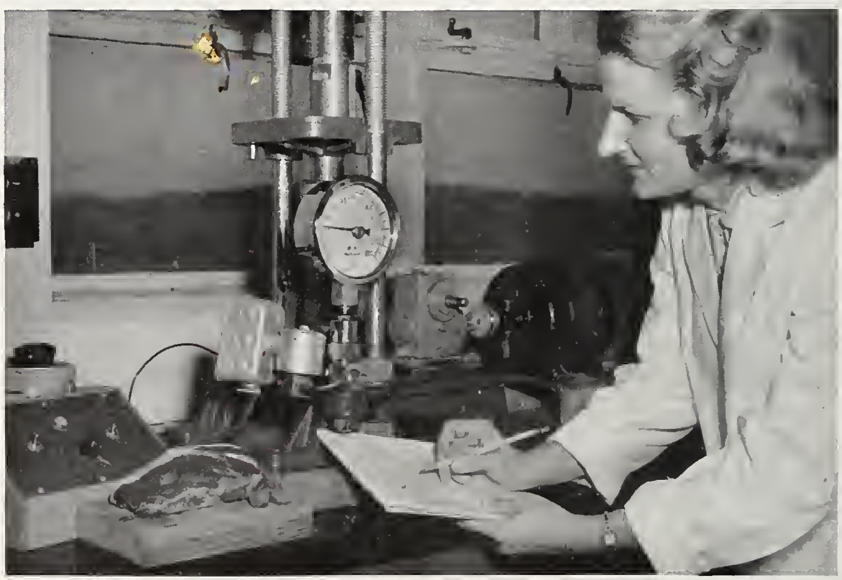
We consider meat tenderness a highly desirable quality. But it's also one of the most elusive to pin down. Many studies have been carried out to relate physical, chemical, and histological properties of meat to tenderness. Some instruments have been developed to test for tenderness—including one fitted with synthetic human dentures to simulate chewing. But not all have proved reliable. Present carcass grading systems don't accurately indicate tenderness, and there has been no really meaningful way to predict with any certainty whether meat from an animal will be tough or tender.

1. Sample of meat is prepared by Doris Sperring. It should be tested up to 5 hours after slaughter or 24 hours to 3 days later.

2. W. T. Platt puts cylinder with meat sample in press. Reading is taken when meat extrudes from tiny hole in cylinder.



3. Gauge shows meat's relative tenderness or toughness. A reading up to 200 p.s.i. means a tender cut; 200 to 300, moderately tender; over 300, watch out for dentures.



The new tenderness press, developed by ARS meat technologists Doris Sperring, W. T. Platt, and R. L. Hiner of the Agricultural Research Center. Beltsville. Md., quickly and accurately measures the tenderness of a small sample of raw or cooked meat. The instrument correlates well with taste panel evaluations after meat is cooked, and with evaluations made with cooked meat on the commonly used Warner-Bratzler shear.

Pressure indicates tenderness

Meat samples are placed inside a specially designed cylinder, and hydraulic pressure is applied by a variable speed motor. The reading on the pressure gauge when the meat begins to extrude through a hole in the bottom of the cylinder shows toughness or tenderness. Readings are in pounds per square inch.

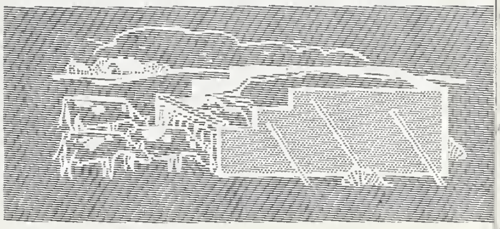
When the press was used in tests to measure tenderness of beef samples cooked after 10 days' aging, the results compared favorably with results on the Warner-Bratzler shear, and with evaluations by taste panels. When the press was used to measure the tenderness of *raw* beef samples aged 3 days, significant correlations were found with the Warner-Bratzler shear and taste panel ratings of meat cooked after the normal 10-day aging period. This indicates that tenderness-press readings on small samples of meat aged 3 days might be used to estimate the tenderness of meat at the usual cooking time.

Index may furnish buying guide

Thus, it's possible that meat could be sold not only with a carcass grade but also a carcass tenderness index. This would enable packers and retailers to assure housewives that they handle only tender beef.

Another possible use for the press is to test the effectiveness of meat tenderizers, by checking tenderness before and after use.☆

A BUNKER SILO SAVES FEED VALUE



■ Can a bunker silo be as efficient as a tower silo for storing grass?

"Yes" is the answer of scientists at USDA's Agricultural Research Center. Beltsville, Md. They put first-cutting orchardgrass in a well-sealed bunker, added a preservative, and then compared it with:

— Similar silage stored in a tower.

— Similar silage in a tower, field wilted, without preservative.

In 2 years of experiments, ARS dairy husbandman C. H. Gordon and agricultural engineer J. R. McCalmont found that bunker silage retained more feed matter than silage stored in a tower. And this high-moisture bunker silage was about equal to wilted silage stored in a tower.

This is the first known experiment, since modern methods of sealing have been available, in which loads of silage from the same field were alternately placed in tower and bunker silos to compare quality and quantity of feed retained and its feeding value.

Losses in the bunker were kept low by sealing with a plastic cover weighted at the sides *and* covered with 2 to 3 inches of sawdust. The silo was filled quickly and each load was well packed by a tractor.

The dry matter saved for feeding was 85.2 percent the first year and 90.3 the second in the bunker, compared with 86.3 and 92.1 for the tower silage that had been wilted. The high-moisture grass placed in a tower silo followed far behind the other two in dry matter with 77.9 and 87.0 percent—because it lost much dry matter in seepage. There was almost no loss through spoilage in any of the methods and they were about equal in gaseous loss. But the tower-preservative silage lost 8.2 and 6.6 percent through seepage while the tower-wilted silage lost only 1.7 and 1.4 percent and the bunker silage lost only 3.7 and 1.8.

The scientists did not try wilted silage in the bunker because they knew it would be easier to keep air out of silage made from high-moisture grass. Encouraged by results, they plan further experiments using wilted materials to see if they produce higher quality silage.

The preservative (sodium metabisulfite) was scattered by hand on the bunker silage after each load had been dumped and spread. It cost $.80 to $1 for the 8 pounds used in each ton of silage.

All forages were chopped with a harvester set for a 3/8-inch cut. Moisture content of wilted silage was lowered to about 70 percent.☆

CELL STRUCTURE: Key to Apple Quality

Storability, texture, and cooking properties are revealed by microscopic examination and chemical analyses, which are correlated with reactions from members of a taste panel

■ Cell structure is the key to keeping quality and texture in apples. Texture is also affected by chemical composition, as is flavor.

These relationships became evident when findings from microscopic examinations and chemical analyses were correlated with taste panel reactions in USDA studies comparing freshly harvested and stored apples—in raw, sauce, or baked form. The research was conducted by food specialist Mary E. Kirkpatrick, histologist Ruby R. Little, and their coworkers in the ARS Institute of Home Economics.

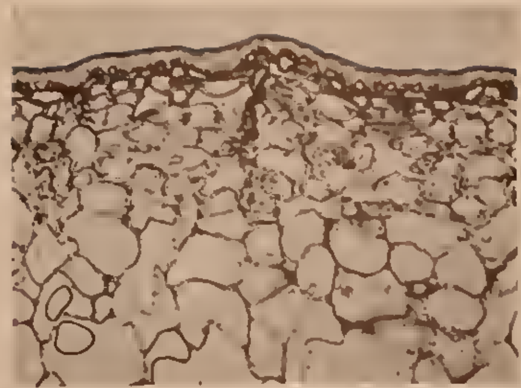
Apples that kept best in storage, such as Delicious and Rome Beauty, had a smooth skin of even, well-formed cells. Such apples had a minimum of russet (corky material replacing outer skin), breaks, channels, or spongy pockets. Unmarred skin probably slowed down loss of gases and moisture from the apples—reducing wrinkling, shrinkage, and spoilage. For example, Delicious apples with little russet when stored shriveled only 3 percent. Golden Delicious variety with much russet when stored showed 80 percent shriveling. Thickness of skin had no relation to keeping quality.

Firmness is characteristic of good-storing fruit

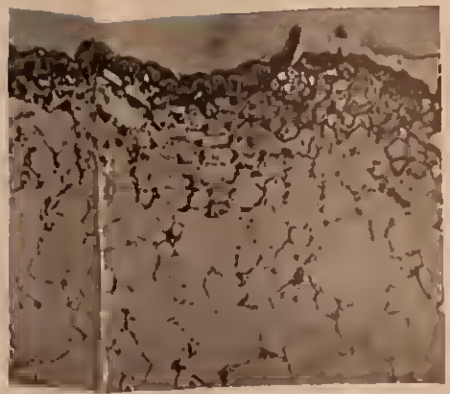
Another characteristic of apples that stored well was firm flesh with a high concentration in cell walls of such carbohydrate compounds as pectin and hemicellulose. Usually a crisp flesh texture in raw apples was associated with high acidity and natural flavor, although such apples tended to lose their shape in baking.

As complex carbohydrates in apples change to sugars in storage, the fruit loses hemicellulose and pectin, softens, becomes mealy and sweeter with loss of flavor.

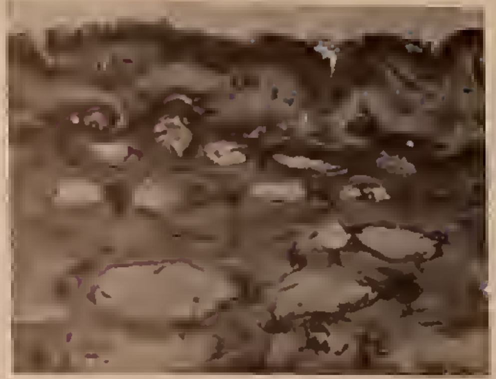
KEEPING QUALITY



Keeping quality depends to great extent on cuticle (waxy surface layer). Smooth, regular cuticle of this Rome Beauty has no breaks, channels, or russet.



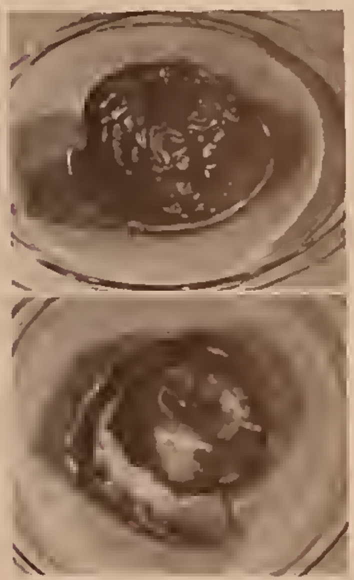
When russ[et] [d]amages cuticle, apple deteriorates quickly. R[uss]et on this Golden Delicious allows excess loss [of] gases and moisture during storage.



Erosion, spongy areas mark cuticle of this Golden Delicious (scale 5 times that of preceding cuts). Skin is tender, breaks easily, or apple shrivels.

Channels in Jonathon are weak spots where skin may break and cause early deterioration. Channels also make possible large losses of moisture, gas.

BAKING QUALITY

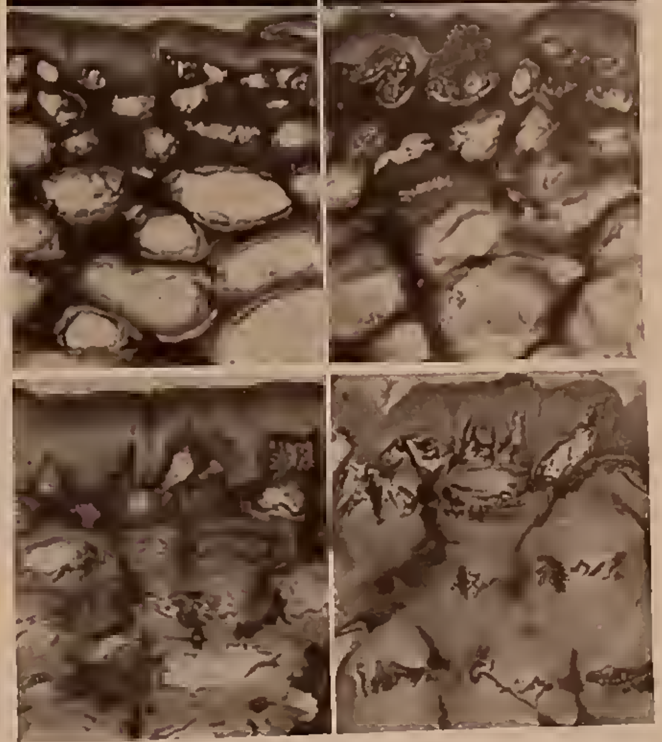


Baked apple at top is Delicio[us] variety; smooth, homogeneo[us] skin, less tender than in oth[er] varieties, holds to flesh durin[g] baking—drawing in and wrin[k]ling as flesh shrinks with loss [of] moisture. Cell walls remo[in] intact, hold together with fe[w] ruptures; flesh maintains [a] firm texture. In Jonathon opp[osite] below, the skin cracks but hol[ds] its shape, separating from th[e] flesh. Cells rupture and com[e] apart. Tasters liked the s[oft] flesh and cracked skin.

COOKING QUALITY

Upper photomicrographs show cross sections of Delicious apples—row (left) and cooked (right). Below are raw and cooked Stayman apples. Delicious apples have firm flesh due to high amounts of pectins and hemicellulose, shown by dark stained walls. Cooked walls show little swelling or weakening. The thick walls of Staymon apples, with low pectin and hemicellulose, are fragile and, after steaming, so swollen and spongy cell cavities are almost closed. The swollen walls contain a flaky breakdown.

Uncooked	Steamed

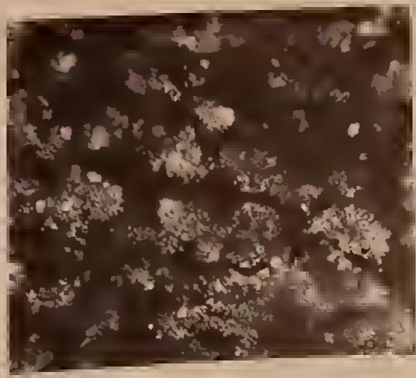


In cooking, cell walls soften and swell because o[f] changes in hemicellulose and pectin, and the apple be[]comes more tender. Jonathan, Stayman, Golden De[]licious, and Rome Beauty apple cell walls near the ski[n] swelled considerably and showed a structural change th[e] scientists name flaky breakdown. In flaky breakdown, cell walls show small flakes that look, under polarized light, like partially gelatinized starch granules. The re[]searchers suggest that the flakes may be cellulose components that have been altered by steaming.

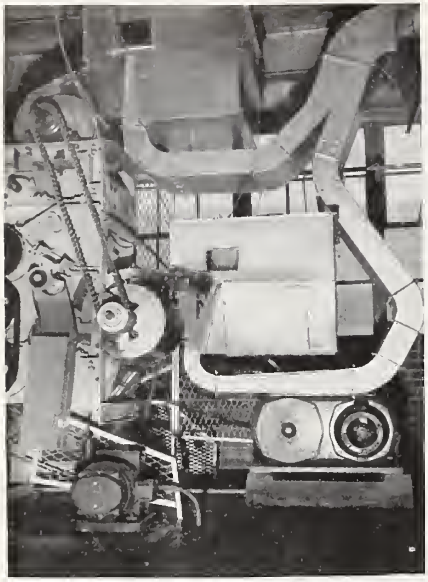
Firmness after cooking may depend on amount and kind of cellulose, hemicellulose, and pectins originally present and the extent of hydrolysis or alteration of these substances during storage or cooking. Delicious apples with small cells, and walls apparently high in hemicellu[]lose and pectins, had firmest cooked flesh and showed least rupture and flaky breakdown. Cell walls of Golden Delicious, Jonathan, and Stayman varieties appeared more fragile and yielded softer baked apples and smoother sauce—generally preferred by taste panelists. The latter two varieties were also high in acid. Stored apples had softer flesh when baked and produced thinner apple sauce than freshly harvested apples.

Flesh separates from skin in best baking apples

Delicious and Winesap apples had firm texture and less tender skins after baking. Stayman became soft and mushy. Delicious apple skin wrinkled during baking because it clung to the firm flesh, which shrank during baking. Skins of Jonathan and Rome Beauty retained their shape because the flesh separated from the skin. They were considered by taste panelists best for baking. In some cases the skin cracked, but tasters liked some skin cracking and softness without mushiness.☆



In polarized light, shiny particles show up in spongy, swollen cell walls — called floky breakdown. The highly refractive bits seem to be cellulose altered by steaming. Apples with such floky breakdown made smooth, soft sauce.



Two aerodynamic cleaners are used to handle output of one opener-cleaner. Arrows in diagram indicate paths of cotton being cleaned. The brushes remove the lint from the revolving cylinders. The cotton moves on air current created by brushes to sharp bend in duct. There the trash drops into box. Most efficient cleaning occurs if air velocity is 1,200 to 1,650 feet per minute at opening in duct. At this point air velocity is stepped up to 3,500 feet a minute.

Mills can boost Efficiency and Capacity with

A NEW COTTON CLEANER

Device is attached to machines developed earlier to prepare baled lint for the spinning process

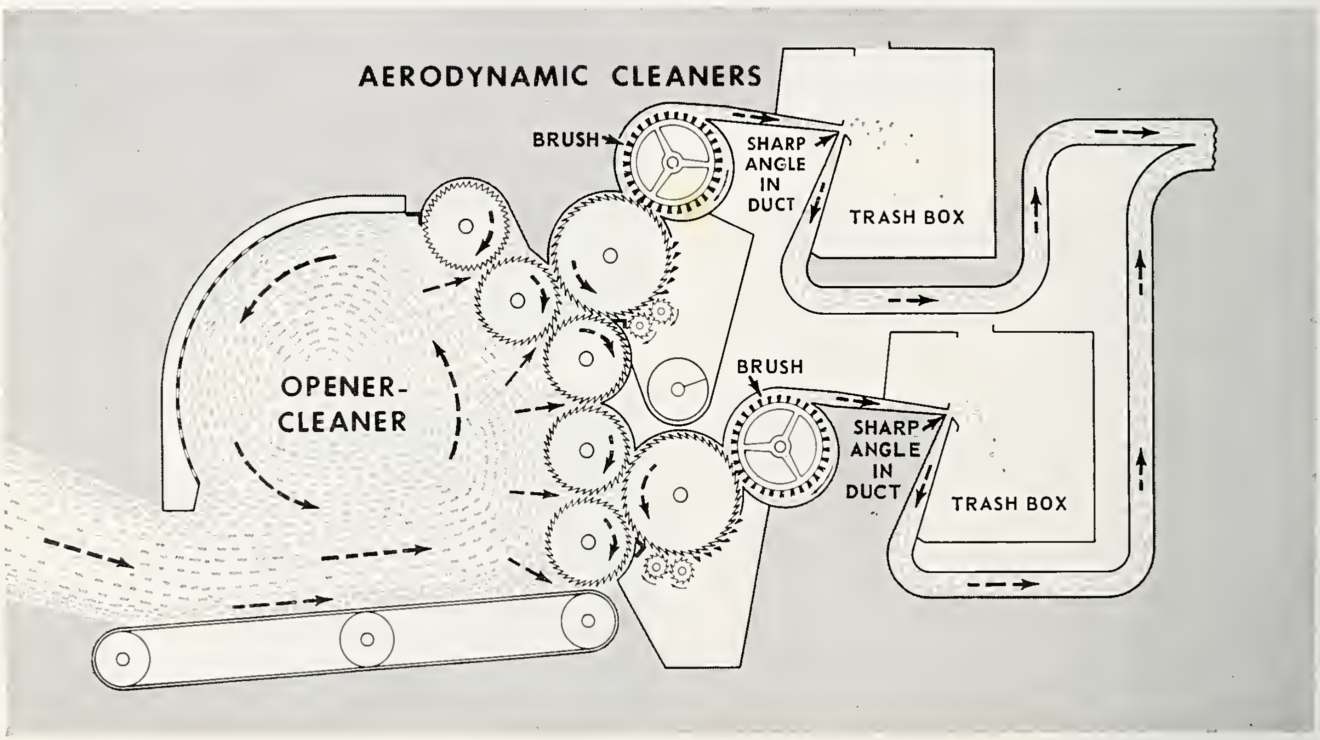
A new device that removes trash from lint cotton can promote more efficient processing and add to textile-mill cleaning capacity.

Called the SRRL aerodynamic cleaner, this device is attached to the SRRL opener-cleaner or the SRRL opener—machines developed to cut mill costs and improve cotton products. The opening machines fluff and blend cotton, and remove some trash, in preparation for spinning.

The aerodynamic cleaner increases by about one-third the capacity of the opener-cleaner: together, they remove 35 to 45 percent of the trash from lint cotton. Used with the opener, the aerodynamic cleaner removes about 15 percent of the trash. An important advantage of the cleaner is its ability to remove "pepper" trash—tiny bits of leaves and bark.

The aerodynamic cleaner was designed by USDA utilization engineers M. Mayer, Jr., J. I. Kotter, R. A. Hetherwick, and H. W. Weller, Jr., supervised by R. A. Rusca. They are members of the ARS Southern utilization division, New Orleans. Their work is part of an overall USDA effort to develop improved farm and mill machinery for cotton production. The opener-cleaner and opener also were developed at New Orleans.

Both opening machines fluff up cotton to about 10 times its baled vol-



ume, making it easier to clean and reducing the loss of spinnable lint. The machines do an excellent job of blending cotton from different lots to produce smoother lint for spinning. resulting in stronger, better quality yarn. Demand for such machines came when mechanical pickers, plus increased rough hand picking, brought more and more trashy, hard-to-clean cotton to mills.

Some trash removed by openers

The opener-cleaner itself removes 25 to 35 percent of the heavy and fine trash in lint cotton, while the opener alone shakes out only some of the heavy trash. Standard cleaning equipment is used to remove remaining trash after the opening process.

The aerodynamic cleaner is attached to the output end of the opener-cleaner. Specially designed brushes, which also act as fans, sweep cotton from toothed, revolving cylinders and carry it through a duct to a cleaning area. There is a sharp bend in the duct just before the cleaning area. Impact loosens the trash as the brushes contact the cotton. Then it's whipped around the bend, and trash is tossed aside.

Developmental work on the aerodynamic cleaner was done on an 800-pound-per-hour prototype opener-cleaner. Although its capacity is only half that of commercial units, it is adequate for use in small mills.

Nonexclusive licenses available

Directions for installing the new aerodynamic cleaner on the opener-cleaner are available to industry. Directions for attaching the aerodynamic cleaner to the opener will be available in a few months.

A public service patent has been applied for, and nonexclusive licenses may be obtained from the Secretary of Agriculture to manufacture the aerodynamic cleaner in the U.S. on a royalty-free basis.☆

BETTER CHERRIES FOR THE NORTHWEST

■ Several promising cherry seedling selections may be introduced as varieties and released to Northwest growers in the near future.

Some selections that bear dark-colored fruit and others that produce light-colored fruit are being developed by USDA horticulturist H. W. Fogle. They definitely have commercial possibilities, though none yet has every desired characteristic. The ARS scientist is making additional crosses to incorporate some of the missing characteristics.

These experiments are conducted with the cooperation of the Washington Agricultural Experiment Stations.

General information about the selections will not be available until they can be named and released to growers, because certain ones may be discarded after additional tests.

Bing, Van, Giant, Gil Peck, Republican, Black Tartarian, Deacon, Seneca, August Supreme, and Napoleon varieties are parents of the selections in the experiments at Prosser, Wash. Bing, the most popular cherry in the Northwest, and Van are the best parents of selections that bear dark-colored fruit. By crossing the parents, Fogle obtained selections that produce fruit with quality as desirable as Bing, and with other features superior to Bing. His goals are selections that are more winter hardy and less susceptible to disease. and fruit more resistant to rain-cracking and adaptable to fresh and processing uses.

Dark-fruited selections could lengthen harvest season

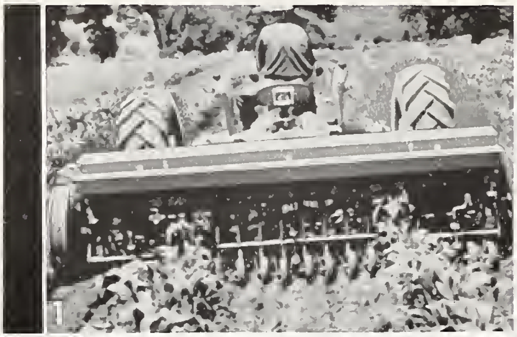
Fogle also is developing dark-fruited selections that ripen successively through several weeks. This could extend the harvest season to about 5 weeks, instead of the usual 3 weeks. Thick, nonbrowning stems are being sought since buyers often judge cherries overripe, after long-distance shipment, on the basis of a thin, dry, brown stem.

Primary interest was in developing dark-fruited cherry selections, but a number of types that bear light-colored fruit were produced by the crosses. These cherries are as large, firm, and attractive as those of the dark-fruited selections.

Two of the selections that produce light-colored fruit are outstanding and could renew interest in Northwest white cherry production, which was about wiped out by a freeze in 1955. The market for white cherries was limited to processing.

Fogle considers the outstanding selections that bear light-colored fruit good enough for fresh as well as processing uses. Selections developed produced a crop following the 1955 freeze and a second in 1957, while Bing did not get back into good production until 1958.☆

Reducing Cornfield Erosion



Conventional grain drill (1) with packer wheels, minus one drill assembly, is used to plant hay crop. Corn is 10–25 inches tall. Hay, well established by fall (2) produces good crop next year (3).

Here's a plan that decreases water runoff while hay crop grows between rows of corn 60 inches apart

■ Erosion on steeply sloping cornfields in Wisconsin has been reduced in USDA-State research by:

— Planting the corn directly on newly plowed, unharrowed fields.

— Seeding a hay crop between the rows of corn.

The new practices were tested on a silt-loam soil of 16-percent slope by ARS soil scientists O. E. Hays and R. E. Taylor, in cooperation with the Wisconsin Agricultural Experiment Station.

These practices reduced erosion because the rough surface of the newly plowed seedbed decreased water runoff, until the hay crop grew out and covered the soil. The hay crop continued to protect the soil after the corn was harvested and during the next spring's rains, when the ground would usually be bare.

However, this combination of practices is effective only where a hay crop can be established during the summer months. The humid, northern part of the country is the only region that has sufficient soil moisture and is not too hot. Even here, there is always some possibility that the hay crop will not establish itself if the weather is exceptionally dry. Results over the past several years, however, have shown no failures.

In areas where the practices would be effective, a rotation of corn-hay-hay would replace the corn-oats-hay that is now common throughout the eastern half of the country.

Soil loss cut more than a half

Corn yields did drop 18 percent in the ARS tests, largely because the corn had to be planted in 60-inch rows to leave room for the hay crop. But less than half of the soil normally washed away was lost, and the alfalfa-brome hay the next year made up much of the feed loss by producing half again as much feed as oats did in the conventional rotation.

The alfalfa-brome was interseeded between 60-inch corn rows because the scientists found that conventional 40-inch rows result in poor legume stands. The 60-inch spacing has also proved more effective than skip-row planting (40-inch rows with every third row omitted).

Corn planted in wheeltracks

A firm seedbed for the corn was obtained by planting in the wheeltracks of the tractor. This also resulted in a smoother hayfield because later cultivation of the corn tended to level the ground rather than ridge it along the rows.

The scientists found that the rough surface of the field was *not* a factor in the decreased corn yields. There was no decrease at all where they planted on a rough field using regular 40-inch rows and not interseeding with hay. Of course, the erosion control was not as effective as when hay was interseeded.

Hays and Taylor recommend seeding the alfalfa-brome when the corn is 10 to 25 inches high. After corn is 18 to 24 inches high, it grows so rapidly that it may become too tall within a week or less to interseed. Corn taller than 30 inches is extremely difficult to interseed with most present-day equipment without severe reduction in stand due to stalk breakage.

Several machines have been tested. Best results were obtained with a grain drill equipped with packing wheels and with one drill assembly removed. Higher soil losses occurred when a cultipacker was used.

In wet years, weed growth may limit survival of the alfalfa. This can be controlled by clipping or by using herbicides.☆

HOW TO CUT TUNG FERTILIZER BILLS

Nitrogen and potassium applications can be safely reduced without cutting profits

■ Tung growers struggling to keep the cost of producing tung fruit and oil as low as possible will be heartened to know they can ease up a bit on fertilizer—especially nitrogen and potassium—in off-crop years.

Fertilizer has always been a whopping item in their account books; growers cutting down costs always start here first. Yet the belief has always been—the more the nitrogen and potassium, even in lean crop years, the higher the production. But this isn't always so, according to State-USDA researchers, backed up by evaluation of years of fertilizer application on tung trees.

How *can* we safely reduce the fertilizer bill and still get the most out of the tung crop? The long-range fertilization studies at the South Mississippi Branch Experiment Station, Poplarville, and at other places, suggest benefit from only moderate applications of nitrogen and potassium in lean-crop years. In fact, applying only a little nitrogen or even none at all was profitable in some of the studies. In others, excessively high levels of potassium actually reduced yields.

Production of tung fruit gradually increased in one of the 7-year tests as a complete fertilizer mixture of nitrogen, phosphorus, potassium was increased each year up to 1 pound per year of tree age. But when more nitrogen and potassium were added to the mixture and application rate boosted up to 2 pounds per tree per year of tree age, there was no increase in production.

Excessive fertilization may actually cut yield

In another study, average fruit yields were 1.5 tons per year on 50 pounds of nitrogen, 1.6 tons on 100 pounds, and 1.2 tons on 150 pounds.

In another test designed to find the upper limits of response to nitrogen and potassium, average annual yields were 2.4 tons per acre on 90 pounds of nitrogen, 2.3 tons on 180 pounds, and 2.3 tons on 270 pounds.

Likewise, there weren't any yield differences in response to applications of potassium fertilizer equal to or higher than nitrogen levels.

The scientists warn against misinterpretation of the test results. It's true that this work shows you *can* overdo use of nitrogen and potassium in lean crop years. But too enthusiastic cutting down of these fertilizers isn't good either. For as a rule, nitrogen *does* increase tonnage and potassium *does* increase oil content. The studies emphasize that the point of profitable return in low-crop years is exceeded at 200 pounds of nitrogen and 300 pounds of potassium per acre.

Best levels seem to be nitrogen at about 125 pounds per acre, phosphorus at 60 pounds of phosphorus pentoxide, and potassium at 150 pounds of potassium oxide.

Little nitrogen needed after light fruit yield

Even with a low nitrogen level, there'll be enough growth in years of low crop production, and flower buds adequate for a good crop the following year will be formed. Under some circumstances, such as a complete crop loss due to freeze, trees may not need any applied nitrogen at all. A heavy fruit crop will be set for the following year even without fertilization. Trees that were fertilized when there was no crop became so large the following year that the branches interlaced and the lower ones were shaded out. Thus, the potential bearing area was considerably reduced.

In years when crops are small, oil content may be satisfactory with little or no potassium fertilization. But this may result in such a serious lowering of the potassium reserves of the trees that they may not recover in a heavy crop year. More than one season may be needed to bring the potassium back to top level, especially since a heavy fruit crop usually follows a light crop. Thus, potassium fertilization can't be safely reduced in off-crop years as is possible with nitrogen.

Whether fertilizer is applied heavily or lightly, it's important to spread it well, preferably by machine in 4- or 5-foot bands near the outer edge of branches.☆

Tung trees are examined by USDA scientists. Recent tests indicate that use of nitrogen and potassium can be overdone in off-crop years. Using moderate amounts of both when crops are lean assures best yields later on.

Glass tubes containing alkali bee pupae are placed in hole by G. E. Bohart. Bundle of tubes is put in upright with wax-sealed end about 1 inch below soil surface.

Global Trips for Alkali Bees?

Commercial shipment of valuable pollinators may expand alfalfa seed production

■ A method of using small glass or plastic tubes for transporting and establishing alfalfa-pollinating alkali bees throughout the world is being developed by USDA and State scientists.

If alkali bees and certain other similar species could be shipped commercially, new alfalfa seed-producing areas could be opened in this country and abroad. Alkali bees, more efficient alfalfa pollinators than honey bees, do not naturally inhabit many potentially good seed-producing areas. Currently, the bees live only in certain areas west of the Rocky Mountains. It is likely that they could be established in similar climates in various parts of the world.

ARS entomologist G. E. Bohart is testing the tube method he developed in cooperation with the Utah Agricultural Experiment Station, Logan. California station researchers are studying intercontinental shipment of the insects. Other cooperative studies are underway in Oregon, Idaho, Washington, and Wyoming.

Larva sealed in each glass or plastic tube

Bohart is sealing one mature alkali bee larva in each 5/16- by 2-inch tube, previously sterilized in boiling water. The larvae are sterilized by dipping into a liquid fungicide to prevent the possible spread of diseases. Cotton plugged into the lower end of each tube provides ventilation and absorbs excess moisture, and honeycomb wax seals the upper end.

Larvae in the lightweight tubes could be shipped by boat, bus, plane, train, or truck and placed in soil near nesting sites when the larvae become pupae.

Bohart earlier studied the possibility of transporting whole nests of alkali bees (Agr. Res., August 1958, p. 8). He drove 11- by 11-inch steel cylinders down around nests, which were removed and put in trenches in a new site. This method was discarded because of the heavy weight, plus the fact that parasites, other insects, and weed seeds could be transported. And it would not be known how many larvae were encased.

About 95 percent of pupae eventually emerge

Now, pupae in bundles of 25 tubes are being successfully placed in the soil with the wax-sealed end up to allow the bees to escape after emerging. The best rate of emergence, about 95 percent, has been obtained by placing the tubes about 1 inch below the soil surface a week or so before the bees emerge.

The entomologist says natural or artificial nesting sites should be provided for newly emerged bees. The best natural nesting sites are in sunlit, fine-silt soil with a firm but not hard-crusted surface. A moderate subsurface moisture supply is necessary to keep the soil damp. Salt is needed to draw moisture to the surface and to keep vegetation short and sparse.

W. P. Stephen of the Oregon station found that artificial nesting sites can be made in an excavation 3 feet deep, lined with polyethylene plastic. The plastic is covered with 1 inch of soil for protection and a 6-inch layer of gravel to conduct moisture. The site is filled with salty, fine-silt soil to provide living space for the bees. Pipes, for adding water, are inserted vertically in the soil to the gravel.☆

Lab at Watkinsville

A new laboratory building and facilities make USDA's Southern Piedmont Field Station, Watkinsville, Ga., the largest and best-equipped Federal soil and water conservation research center in the Southeast.

The new $550,000 setup is designed for cooperative ARS-Georgia Agricultural Experiment Station studies of soil and water management and conservation farming.

Results of research at the station are directly applicable to the Southern Piedmont region — including parts of Alabama, Georgia, and North and South Carolina. However, many findings are basic enough to be applied to all soil and water conservation activities in the Southeast.

Among special features of the new installation is a growth room, which permits scientists to duplicate the high-intensity sunlight of the area. Purpose of this is determination of the sun's effects on soil structure, plant growth, and on moisture loss by transpiration and evaporation.

Three new tangerines

Three early-maturing tangerine hybrids have been developed by USDA scientists from crosses between the tangerine variety Clementine and the tangelo variety Orlando.

Robinson, earliest of the hybrids, sometimes breaks color by September

15 and reaches prime eating condition in late October. Osceola is high colored. It is lower in solids content and higher in acids content than Robinson. Both are medium sized. Lee resembles an orange in size and shape, has medium solids content and rather low acids content. Osceola and Lee are best in November.

ARS horticulturists P. E. Reece and F. E. Gardner, who selected the hybrids, warn against extensive plantings until more information is available on cold tolerance, rootstock preference, disease and insect susceptibility, and pollination habits.

A tobacco first

The first tobacco line resistant to root-knot nematodes has been developed by USDA and the South Carolina Agricultural Experiment Station. Seed is being released to breeders of flue-cured and other tobaccos.

Known as PD 611, the basic breeding line will be used as a parent in producing commercial varieties resistant to the destructive nematode disease. It is being introduced as a line rather than a variety because its cured leaves are below top quality and not acceptable to some manufacturers. PD 611 lacks resistance to black shank, bacterial wilt, and fusarium wilt diseases.

Tests showed that PD 611 has acceptable levels of nicotine and sugar and satisfactory flavor and aroma. When grown at several locations in North and South Carolina in 1958 and 1959, PD 611 yielded 1,800 to 2,000 pounds of cured tobacco per acre. In comparative tests, PD 611 often yielded up to 200 pounds more cured tobacco per acre than Hicks.

ARS plant breeder T. W. Graham developed PD 611 in cooperation with the South Carolina station. Plant breeders may obtain seed from Graham at the Pee Dee Experiment Station, P.O. Box 271, Florence, S.C.

Pest's presence confirmed

The pumpkin caterpillar, a foreign pest of the cucurbits, has been in Florida for years. But only recently was the pest identified and its presence confirmed by the Florida State Plant Board and USDA.

The pest is widespread in central and southern Africa, southern and eastern Asia, Australia, and many of the Indian and Pacific Ocean islands. It feeds on cucumbers, melons, and squashes. The pumpkin caterpillar has been known, however, to attack such cultivated crops as beets, cotton, soybeans, and eggplant.

The caterpillar was collected in Manatee County in 1955, in Sarasota County in 1957, and in Dade County in 1958 by insect-collector C. P. Kimball, but the pest was not identified. ARS taxonomist H. W. Capps recently examined undetermined specimens in the U.S. National Museum insect collection and showed that the pest also has been in South America and the West Indies for some years.

The caterpillar probably was not recognized because it resembles its kin, the melonworm and pickleworm, and feeds on about the same plants.

Land for citrus studies

A group of Florida citrus growers and industry leaders has purchased 500 acres of land near Leesburg, Fla., for use by USDA researchers in improving citrus stock.

The Florida Citrus Research Foundation, organized to make the purchase to aid research, is leasing the property to USDA rent-free for 99 years. The Foundation is raising $150,000 for the land, plus $50,000 for land improvement. Studies there will supplement work at the U.S.

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Horticultural Station, Orlando.

Some objectives are early and extra-late varieties of oranges and grapefruit to extend the processing and fresh-fruit marketing period; good eating and shipping varieties of "kid-glove" oranges that have a wide marketing season; varieties that produce more and better colored juice and more sugar per acre; and cold-resistant rootstocks and scion varieties that produce high-quality fruit in Florida's variable soils.

ARS will maintain the collection of over 600 citrus varieties and species—largest such collection in the world—for breeding, rootstock, and selection work there.

Hay safe in 10 weeks

Hay contaminated with beef tapeworm eggs can be safely eaten by cattle, *provided* it's stored long enough for the eggs to be no longer viable and capable of infection.

Recent USDA findings point to 10 weeks as a safe storage period for tapeworm-contaminated hay. None of the eggs in the hay were viable after this period of time. Even after 3 weeks, only a few were viable.

This tapeworm is found in cattle in a cystic or larval form (*Cysticercus bovis*). Losses come from condemnation of heavily infected carcasses and greater processing costs. The adult tapeworm (*Taenia saginata*) is found in man.

Recent localized outbreaks of *C. bovis* infection prompted disease eradication officials to consider that hay contaminated with beef tapeworm eggs may have been responsible. This led ARS parasitologists J. T. Lucker, Jr., and F. Douvres of the Agricultural Research Center, Beltsville, Md., to determine how long

such hay must be stored to destroy the viability of eggs.

Eggs and ripe proglottids (egg-containing tapeworm segments) were placed on alfalfa hay in unsealed tubes. The tubes were put in a bale of alfalfa in a loft. (Outside temperatures ranged from −11° to 87° F.) Tubes were removed at intervals, the contents mixed with meal and fed to calves. Later, the calves were slaughtered and checked for degree of infection with *C. bovis* cysts.

Only 1 cyst, located in the cheek, was found in a calf that ate eggs stored in the hay for 22 days. None was found in a calf that ate eggs stored in the hay for 71 days. A control calf that received an equal number of eggs when they were fresh was heavily infected.

Eartag system popular

A uniform eartag number plan for cattle has been adopted by the Dairy Herd Improvement Association and Artificial Breeding Program in all 50 States. The plan also is used in cooperative Federal-State animal disease eradication in 42 States.

Identifying numbers are on a metal tag that is inserted in an animal's right ear. The number series, found practical for many years in ARS dairy herd improvement activities, provides a combination of letters and numbers sufficient for tagging more than 8 billion cattle in the United States or 175 million in each State without a single duplication. Each tag is stamped with a two-digit State code and a three-letter prefix followed by four digits.

The system was first proposed by USDA in 1955 (Agr. Res., December 1955, p. 15) to eliminate confusion caused by use of different types

of identifying markers in herd improvement or disease control efforts.

Central recording offices in the subscribing States assign a specific series of numbered tags for each use. Tags can be applied on various occasions, such as first vaccination or first disease test. Once applied, an eartag becomes a permanent identification for the animal.

Dairy herd improvement and artificial breeding associations use the uniform eartag numbering system in conjunction with individual records showing the location, movement, health status, production, and breeding activity of each animal.